Math 524: Topics in PDE, Spring 2016

Instructor: Prof. Alexander Kiselev
Office: HBH 428
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Class Hours: TTh 10:50-12:05
Classroom: HBH 453
Office Hours: Tu 2:30-3:30pm, also by appointment.

Texts:
We will not strictly follow any textbook. Parts of the material covered can be found in *Vorticity and Incompressible Flow* by Andrew Majda and Andrea Bertozzi

Pre-requisites: I will assume familiarity with real analysis and functional analysis on the level of first graduate courses in the subject. Some exposure to PDE is useful but not really necessary.

Topics to be discussed: The class will be devoted to equations of ideal fluid. Ideal means incompressible and inviscid. The equations ruling the motion of such fluids have been written down by Leonhard Euler in 1755. Amazingly, there are many basic questions about these equations that remain unanswered. One example of such question is whether in three dimensions and for reasonable initial data there exists a unique global solution. We will discuss both 2D and 3D Euler equations, starting with the foundations of existence/uniqueness theory and proceeding to some recent research results. This will involve discussing some auxiliary models developed to better understand the equations, and deploying a wide array of analytic techniques. If time permits, we will also talk about other equations of fluid mechanics such as surface quasi-geostrophic equation and a related class of equations called active scalars.

Objectives and outcomes: The students will learn the foundations of rigorous mathematical fluid mechanics, with focus on one of the most fundamental equations. The course will present results of recent research and many open problems will be discussed.

Homework: will be assigned regularly.

Exams: there will be no exams.

Grading: will be based on homework.

Absence policy: Attendance is not required. However, it is expected. Not everything that will be mentioned in the class can be easily found in the online sources or subject

literature. It is important to attend the lectures in order to gain better mastery of material and to get maximal benefit from the class.

Disability support: Any student with a documented disability seeking academic adjustments or accommodations is requested to speak with me during the first two weeks of class. All such discussions will remain as confidential as possible. Students with disabilities will need to also contact Disability Support Services at the Allen Center.

Changes to syllabus: Information in syllabus, other than the absence policy, is subject to change with a reasonable advance notice, as deemed appropriate by the instructor.